

Supplementary Note respecting the Use to be made of the Chitinous Organs in the Cheilostomata in the Diagnosis of Species, and more particularly in the Genus *Cellepora*.

(PLATES XXVI. & XXVII.)

I MUCH regret that before drawing up the preceding account my attention had not been called to a suggestion by Mr. Arthur W. Waters* respecting the use of the characters afforded by the *oral valve* or *operculum* in the diagnosis of species in the Cheilostomatous Polyzoa, as I should otherwise have been saved a great amount of time and trouble in the endeavour to establish satisfactory distinctive characters in the perplexing and difficult group of the Cellepores.

But having since devoted much attention to this point, and examined the characters, not only of the *operculum*, as suggested by Mr. Waters, but also, in addition, those of the other chitinous elements of the skeleton in between sixty and seventy species of *Celleporæ*, as well as in numerous species of *Reteporæ* and *Salicornariadæ*, both groups in which the determination of species is often attended with considerable difficulty and uncertainty, I have become convinced that the characters derived from the chitinous organs will be found of the greatest possible utility, and at the same time capable of being employed with the utmost facility and precision.

In fact, so far as my present experience teaches, it appears to me that the characters derived from these parts of the skeleton will prove, at any rate in the three generic groups above mentioned, almost alone sufficient to determine specific distinction or affinity, so that from a very minute fragment of a zoarium, if in the proper state of preservation, the species may, in a few minutes, be made out with the utmost ease.

How far the characters of these appendages may be of use with respect to generic or more general distinction, I am not at present prepared to say, and much doubt whether they will be found extensively useful in that regard.

But at present I am convinced that in future it will be indispensably requisite in the definition of a species, at any rate in certain defined natural groups, to give the characters of the chitinous organs, which are certainly of equal, if not greater, value than those afforded by the calcareous skeleton alone.

* "On Bryozoa," Proc. Literary & Philos. Soc. Manchester, 1878, vol. xvii. p. 125.

It is therefore very unfortunate that the facile, and comparatively more certain, means of diagnosis derived from these parts should not be available in the case of fossil or even of recent forms in which nothing remains except the calcareous frame.

So far as my present limited experience shows, the characters of the chitinous organs, except in size, appear, within the limits of the same species, to be remarkably constant; and if, as in some cases, it happens that some apparent diversity of form (as regards the operculum more especially) exists, it will be found that these diversities may be reduced to the same fundamental type through gradations from one extreme to the other. But in by far the greater number of cases the variability in these parts seems to be far less than in any other parts of the skeleton. And as the form of the *operculum*, though of course usually more or less correspondent to that of the *orifice*, is much less liable to vary or to be concealed or altered by age and hypertrophy of the surrounding parts, it is a character, where obtainable, of greater utility and certainty than that of the *orifice* itself, upon which later systematists have very properly laid so much stress. But though an important character, and one that should always be noted, the mere form or even garniture of the *orifice* seems to me to be one of a subordinate kind; and the attempt to found generic distinctions mainly upon such a single character as the form of the *orifice* alone, must, as in all cases where one or two isolated characters are taken, inevitably lead to confusion from the numerous exceptions that will have to be admitted.

It is for this reason, also, that in the more restricted field of specific distinction it will not do to rely simply on the characters of the *operculum* alone, which, though usually definite enough, must, in many cases, be very carefully scrutinized, and sometimes cannot be discriminated without great difficulty, and sometimes even but very doubtfully at all. But if the characters of the *operculum* are taken in conjunction with those of the other chitinous elements where such exist, the chances that the combined characters of all these parts will coincide in any two really distinct species are extremely remote, if not altogether impossible.

In the genera above noticed this coincidence is even still less likely to occur, since in the majority of species in them there are usually at least two kinds of *avicularia*, and sometimes even three or four; and that similar avicularian mandibles should be found associated with similar *opercula* appears to be hardly credible.

I am not, however, prepared to assert that this is impossible,

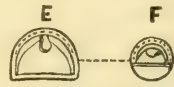
since I am acquainted with more than one instance among the *Cellepores* in which, so far as the general external characters are concerned, the species would seem to be quite distinct, but in which, nevertheless, the characters of the chitinous appendages are so exactly alike that one is compelled to regard them as specifically identical.

In the two accompanying Plates I have given figures of the chitinous elements of a good many of the species enumerated in the foregoing paper, together with those of some other species not included in the 'Challenger' collection, with the view of

- (1) facilitating the diagnosis of the species figured, and
- (2) of showing the mode in which, as it seems to me, this means of diagnosis may be employed.

The chitinous elements of the skeleton in the Cheilostomatous *Polyzoa* consist mainly of the *operculum* or *oral valve* and the movable limb or *mandible* of the various kinds of avicularian and vibracular organs, besides some others of very limited occurrence.

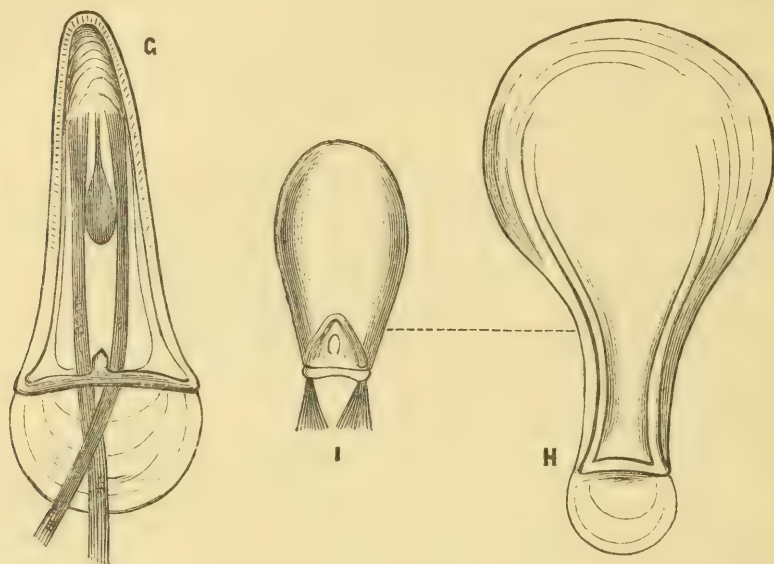
In all the *Celleporæ* we find, besides the *operculum*, one, and usually two or more kinds of *avicularia*. One of these, which invariably exists, is generally of small size, with a more or less semicircular or subtriangular mandible, and placed in close proximity to the border of the orifice, and very frequently on a preoral rostral process or on other elevated processes, or sessile on some part of the peristome. This kind of *avicularium* I have termed the *oral* (woodcut, E & F), and the small peculiar mandible belonging to it will always be readily distinguished. But besides these we almost universally find other avicularian organs of larger size and variously disposed upon or interspersed among the *zoecia*. These are most frequently seated upon special adventitious processes on a *zoecium*, whence they may be termed *adventitious*; or may occupy the place of an aborted or transformed *zoecium* irregularly intercalated among the others, to which kind of avicularium the term *vicarious* may be applied.



These interspersed avicularia of both kinds present the greatest diversity of conformation, and consequently their chitinous mandibular limbs afford the most important differential characters.

This is not the place to enter upon a general survey of the multiform avicularian organs in the Cheilostomata, though this is one of the most important subjects in relation to classification; and I would here merely observe that in *Cellepora* these organs

may be divided, as regards their presumed function, into the *prehensile* (woodcut, G) and the *retentive* (woodcut, I & H). The

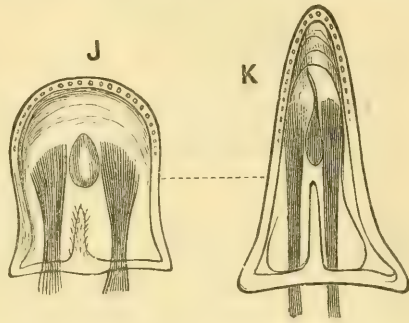


former, from the strength and conformation of the *mandible* and the corresponding *beak*, which is not unfrequently toothed or serrate, as well as from the powerful muscles by which the mandible is moved, are evidently fitted to close down upon living prey of some kind; whilst the latter, having a more or less membranous or extremely delicate mandible, forming, as it were, when closed the lid of a cup-like cavity or receptacle, seem to be adapted for the purpose of simply retaining passive objects; and corresponding with this less active function, the musculature and chitinous framework of the mandible are very much less developed.

There are many points connected with these organs deserving of close study, and numerous variations, sometimes of a minute character, though from their constancy no doubt important, which demand close attention in comparing different mandibles. Among these points may be mentioned the size, form, and position of the foramen which exists in all the prehensile avicularia, and the points of insertion of the occlusor muscles, &c. Amongst other minute and apparently unimportant characters of this kind, I may mention one which appears, from its constancy, somewhat curious, and may perhaps prove to be of some classificatory value.

In many of the species of *Cellepora* belonging to what I have termed the "holostomatous" section, in all the *prehensile* avicularian mandibles (amongst which are included the *oral*) a minute slender projection or tongue may be seen rising from

the middle of the transverse bar forming the base of the mandible. In one or two instances I have fancied that this little projection was beset with short upright *setæ*; but I am by no means sure of this observation, as I have almost universally failed to perceive any thing of the kind. But should it be found in recent specimens, and under very favourable circumstances, that this *lanquette* is so furnished, one might suppose that it formed a sort of tactile organ, the touching of which might induce the sudden closure of the mandible. It might thus, though differently placed, be taken to represent the apparently tactile organ long ago noticed in some other avicularia (see woodcuts J & K). But a curious point connected with this little appendage is, that it is not found in any of the "schizostomatous" Cellepores, so far as my observation goes, but seems to be limited to the holostomatous species belonging to the southern hemisphere alone.



It remains to say a few words on the method I have found most convenient for the procuring of the chitinous elements for the purpose of examination. It is, however, extremely simple and easy, consisting merely in the removal of the calcareous matter from the fragment or specimen to be examined, by immersion for a short time in dilute nitric acid, and, after it has been washed with as little disturbance as possible, staining the flocculent residue with picro-carmin. It should then be *teased* to pieces in a drop of glycerine or gum and glycerine &c. and examined under a covering-glass. All the chitinous parts will, in this way, be displayed of a bright yellow colour.

This mode of preparation, moreover, has the advantage of displaying in great perfection nearly all the soft animal tissues, if any such exist in the specimen, however long it may have been dried. The muscular tissue is especially well displayed in this way, in specimens that have been dried for thirty or forty years, in almost as great perfection as if the specimen had been living; and I have little doubt that any one versed in the modern methods of histological research will be able to make out in specimens of almost any age, if originally in proper condition, and especially if they had been killed by immersion in spirit, almost as much as could be found in a perfectly fresh subject. In one instance, in a

specimen of *Cellepora fusca* from the 'Rattlesnake' collection and thirty or forty years old, I detected several minute tailed corpuscles, which can scarcely be any thing else than spermatozoa (see Plate XXVI. fig. 11).

EXPLANATION OF THE PLATES.

Each square or division contains the chitinous appendages of a single species. All the figures are magnified 115 diameters, and a scale = 0.01 millim. is added.

PLATE XXVI.

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| Fig. 1. <i>Cellepora albirostris</i> , mihi. | Fig. 6. <i>C. polymorpha</i> , var. <i>discoidea</i> . |
| 2. <i>C. albirostris</i> ? (Bass Strait, Mr. Hincks.) | 7. <i>C. Jacksoniensis</i> . |
| 3. <i>C. hastigera</i> . | 8. <i>C. apiculata</i> . |
| 4. <i>C. columnaris</i> . | 9. <i>C. tridenticulata</i> . |
| 5. <i>C. polymorpha</i> , the massive branched form. | 10. <i>C. nodulosa</i> . |
| | 11. <i>C. fusca</i> . |
| | 12. <i>C. zamboangensis</i> . |

PLATE XXVII.

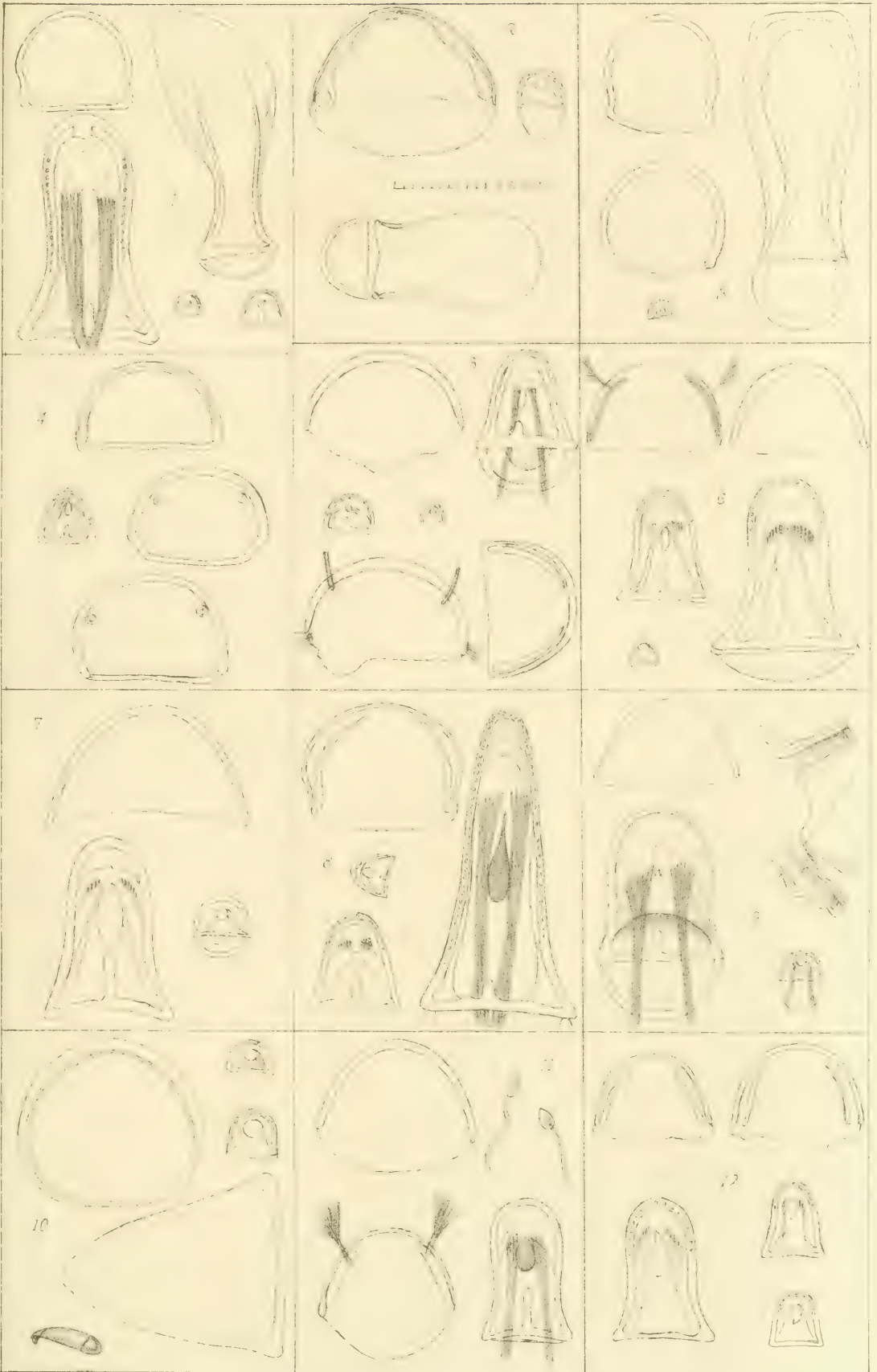
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| Fig. 1. <i>Cellepora ansata</i> . | Fig. 6. <i>C. Eatonensis</i> . |
| 2. <i>C. Eatonensis</i> , massive form. St. 149 D. | 7. <i>C. canaliculata</i> . |
| 3. ———, incrusting form. St. 149 I. | 8. <i>C. bidenticulata</i> . |
| 4. <i>C. bicornis</i> ! | 8a. ——— (young). |
| 5. <i>C. Eatonensis</i> , var. <i>magellana</i> . | 9. <i>C. conica</i> . |
| | 10. <i>C. perlacea</i> (MS.). |
| | 11. <i>C. simonensis</i> . |
| | 12. <i>C. rudis</i> . |

Observations on Ants, Bees, and Wasps.—Part VIII. By Sir JOHN LUBBOCK, Bart., Pres. Linn. Soc., M.P., F.R.S., D.C.L., LL.D.

[Read June 2, 1881.]

Experiments with Light of different Wave-lengths.

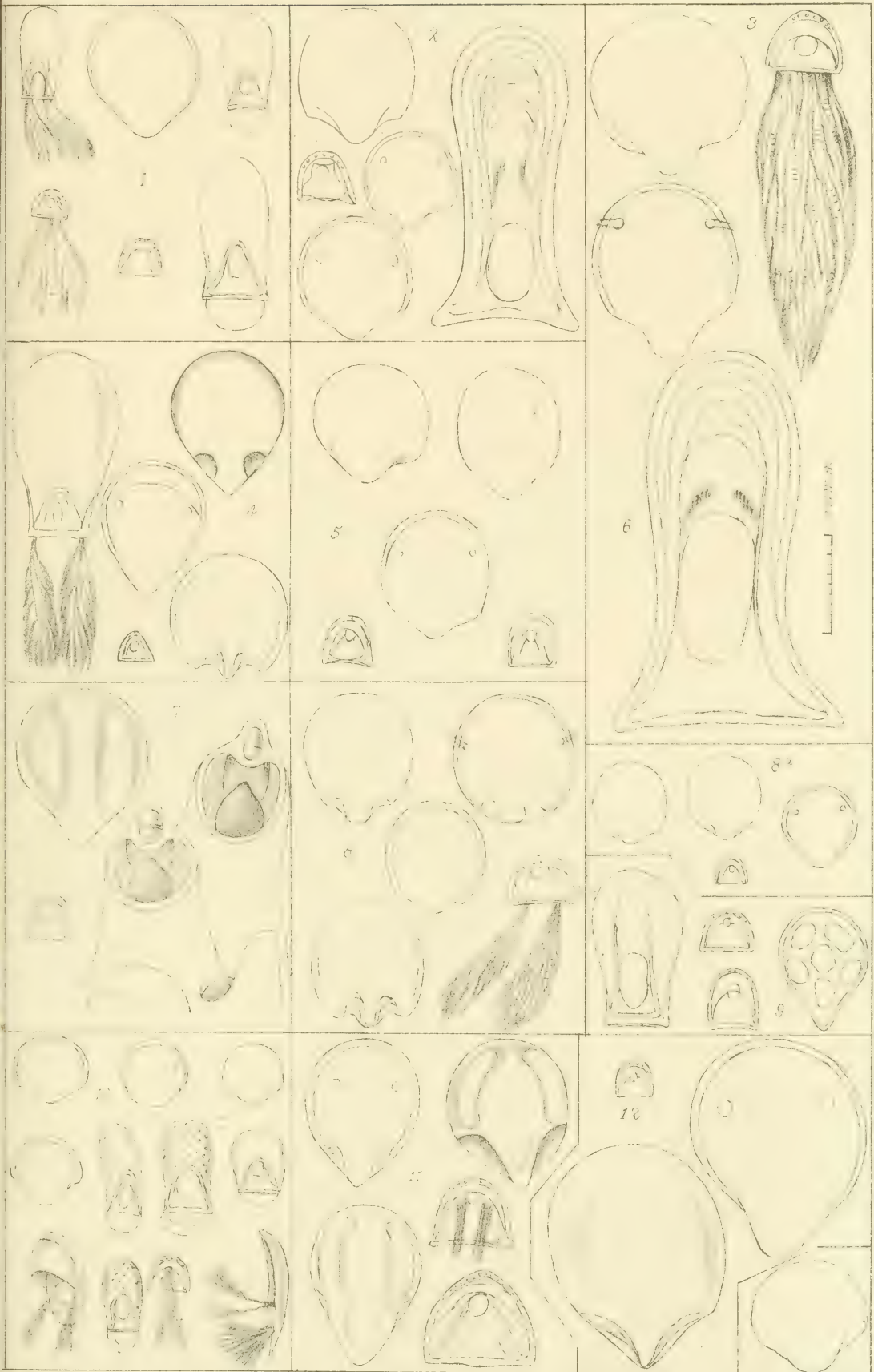
IN one of my former papers (Linnean Journ. vol. xiv. p. 278) I have given a series of experiments made on ants with light of different colors, in order, if possible, to determine whether ants have the power of distinguishing colors. For this purpose I utilized the dislike which ants, when in their nest, have for light. Not unnaturally, if a nest is uncovered, they think they are being attacked, and hasten to carry their young away to a darker and, as they suppose, a safer place. I satisfied myself, by hundreds of experiments, that if I exposed to light the greater part of a nest, but left any of it covered over, the young would certainly be con-



Berjeau lith

Hanhart imp.

CHITINOUS APPENDAGES SPECIES OF CELLEPORA.



Berjeau lith.

CHITINOUS APPENDAGES SPECIES OF CELIATA